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WOOL GROUP MEETING*

(Concluded from last issue)

MILTON HARRIS

Presiding

CHAIRMAN HARRIS: I think most of the people here are interested in wool. There has recently been a lot of interest created, mostly by military needs, in this whole problem of shrinkproofing. As you all know, shrinkproofing is not new. It has been practiced in some place or other in the world for 50 or 60 years, and there have been many attempts—not very large ones, I think I can say—to establish shrinkproofing in this country. For a great variety of reasons, which I shall not discuss now, it has really never gone over. I think I can say that more progress has been made in the last six months in the field of shrinkproofing in this country than at any time in the history of woolen manufacturing, which has largely resulted from the efforts of the Quartermaster General's Office, in order to obtain suitable treatments for military usage.

It has been one of the nicest problems with which I have had the privilege of being associated in Washington, and I can say, without any qualms, that a great deal of its success has resulted from perhaps as good management as we have had on any of our war developments, which management has been brought about by the almost superhuman efforts of Captain Clapham, who has really coordinated an extremely complicated job. He has handled it completely. He has coordinated the work in the various Depots, various laboratories and plants, and in the short space of a few months has converted hosiery mills who had never seen shrinkproofing treatments before to the stage where 60 or more per cent of all the cushion-soled socks furnished for the Army—and that is a prodigious number—are now receiving shrinkproofing treatments.

So I am pleased that we are able to have Captain Clapham here to tell about the Quartermaster's program. He is going to discuss "Shrink-Resistant Treatments for Army Woolens." Captain Clapham! (Applause)

. . . Captain Clapham presented his prepared paper . . . (Applause)

SHRINK-RESISTANT TREATMENTS FOR ARMY WOOLENS*

CAPT. HARRY F. CLAPHAM

IT has been said that an army marches on its stomach. No matter how true this statement may be, an army must also have men with healthy bodies and feet in good condition to move forward and defeat the enemy. Experience over the years has shown that wool is the most desirable clothing material when warmth is required. The natural resiliency of wool, especially when wet, and the resultant warmer, less clammy feel are important factors in making wool one of the standard clothing materials for nearly all the armies of the world. The property of resiliency is so great in wool that even in carded blends with up to 50 per cent of cotton it is very apparent and useful, giving the feeling of warmth and comfort. The use of wool for clothing fabrics for men who are constantly out of doors in cold and damp weather is not confined to army men alone. Hunters, fishermen, lumbermen and others who are out of doors a great deal in cold weather wear woolen clothing almost exclusively.

The use of wool, however, is not confined to cold climate alone. Even in the jungle, socks, wool, cushion sole and shirt, knit, OD are among the most favored items because of the comfort they offer, and in all climates socks, wool, cushion sole are the favored sock for comfort and foot health.

One of the most important properties of wool is its ability to felt or full. You are all well acquainted with the desirability and necessity of the fulling properties of wool for the manufacture of many, if not all, types of woolen fabrics. Without it, it would be impossible to manufacture fine flannels and serges which are basic fabrics in the clothing field, and the soft, lofty finishes obtained on many other woven and knitted fabrics would not be obtainable. This paper, however, is chiefly concerned with the drawbacks of this very important property of wool during the useful life of items of clothing.

Early in the war, the Quartermaster Board, a field testing organization of the Quartermaster General, whose job it is to evaluate the many items of quartermaster issue under field use, made a salvage study of worn garments which had been turned in at the end of their useful life. This study showed that one of the important and prevalent reasons for salvage of woolen items of clothing, such as flannel shirts, underwear, trousers and socks was shrinkage. (See Figure 1.)

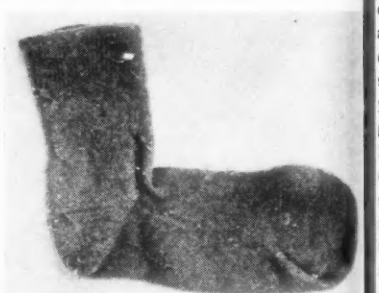


Figure 1. Sock, Wool, cushion sole.

Here is one example of the result of severe field laundering. This sock was originally size 11.

The results of this study indicated that the Quartermaster Corps could effect tremendous savings if shrink-resistant woolen fabrics could be produced. Early last year an extensive examination of the wearing qualities of socks was undertaken. A test of about 25 different types of socks embracing various constructions of socks, wool, light, socks, wool, cushion sole, and socks, wool, heavy was instituted at the Quartermaster Board. The results of these tests, particularly on the socks, wool, cushion sole, which were never worn out but which always shrank to an unwearable size after severe launderings, lent much more urgency to the problem of obtaining shrink-resistant woolens.

* Presented at Annual Meeting, Atlantic City, N. J., October 14, 1944.

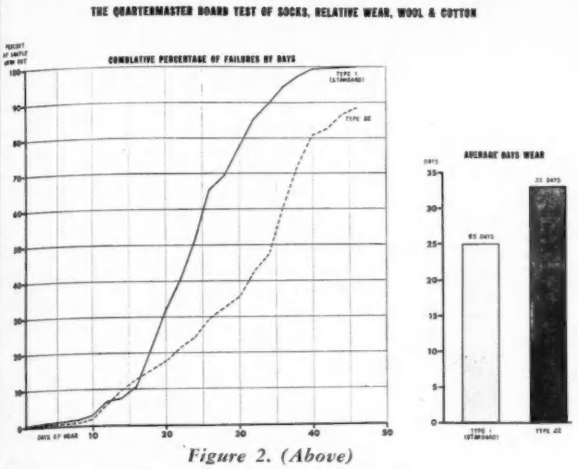
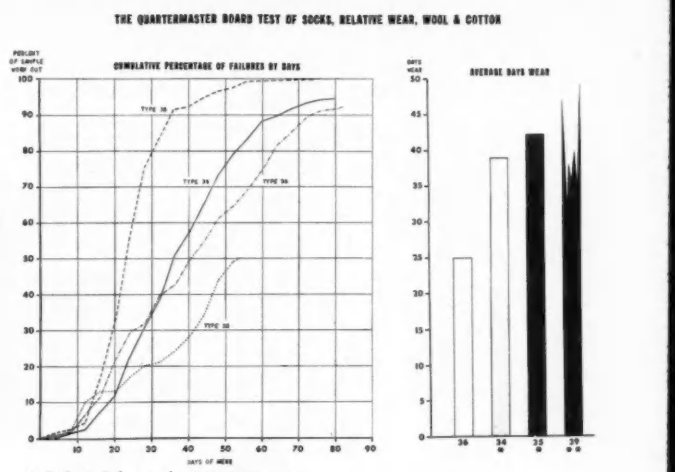

THE QUARTERMASTER BOARD TEST OF SOCKS, RELATIVE WEAR, WOOL & COTTON
CUMULATIVE PERCENTAGE OF FAILURES BY DAYS
AVERAGE DAYS WEAR

Figure 2. (Above)
Type 1—untreated sock, wool, light—60's wool.
Type 22—chlorinated sock, wool, light—60's wool.

Figure 3. (Right)
Type 34—chlorinated sock, wool, cushion sole—60's wool.
Type 35—Freney-Lipson treated sock, wool, cushion sole—60's wool.


THE QUARTERMASTER BOARD TEST OF SOCKS, RELATIVE WEAR, WOOL & COTTON
CUMULATIVE PERCENTAGE OF FAILURES BY DAYS
AVERAGE DAYS WEAR

* Adjusted for socks not worn out.
** No average as only 50 per cent of sample is worn out.

Type 36—untreated sock, wool, cushion sole—60's wool.
Type 39—shrink resistant treated sock, wool, cushion sole—56's to 60's wool.

You may ask why we did not solve the problem of shrinkage on socks, wool, cushion sole by discarding them and using another type; or by modifying the laundering method; or by modifying the construction to minimize shrinkage. Any of you who have been fortunate enough to get hold of a pair of cushion sole socks know the answer as to why we do not discard them. They are the most comfortable socks ever developed for men who have to march long miles. Their acceptance has been practically unanimous by the army, and the only complaints have been on the shrinkage experienced. As to modifying the laundry methods, I can only say that extreme care has been used in setting up laundry methods by the army, but the socks still shrink, and no matter how many orders are issued there will always be times and places where the proper care during laundering is not possible, and shrinkage will result. As to modifications of construction, the Quartermaster Corps has made all modifications which could be expected to reduce the shrinkage of socks, wool, cushion sole. The grade of the wool has been reduced from not lower than 60's to 56's to 60's. The stitch has been tightened as much as is consistent with required elasticity to leave less room for shrinkage, and all army socks are made with a proportion of cotton to reduce the tendency to shrink.

Even after all these precautions were taken to produce the best possible socks, shrinkage still caused failures and unwearable socks. The next obvious step was to determine whether a shrink-resistant treatment would overcome the difficulty and offer a cushion sole sock that could be worn and washed without failure because of shrinkage.

This paper is presented to pass on to you some of the results that have been obtained in the study of various shrink-resistant treatments. While most of what I have to say about shrinkage and shrink-resistant treatments is based on the results of the extensive laboratory and field tests on army socks of various types, it is believed that the processes which have been investigated will be applicable, with modifications, to other woolen materials.

In the announcements of the program for these meetings, this paper was titled "Shrink-proofing of Woolen Fabrics." "Shrink-resistance of Woolen Fabrics" is the preferred title, especially since complete shrink-proofing, particularly on socks, is not required, is probably undesirable, and certainly is extremely difficult to obtain without undue modification of the wool. You will also note I said "modification" of the wool. "Damage" is the term usually applied to any chemical change made in wool, but where the change is beneficial rather than detrimental to wearing life "modification" would appear to be a more suitable term.

In the field test of various types of socks already mentioned, there were included a set of light-weight wool socks identical to the control standards except for a chlorination treatment. The controlled wearing tests of these two types of socks showed a 30 per cent longer life for the chlorinated shrink-resistant sock. (See Figure 2.)

Based on this evidence, steps were immediately taken to treat socks, wool, cushion sole to make them shrink-resistant to determine whether their life could be similarly extended. Selected groups of socks were treated by a chlorination process and also by the so-called Freney-Lipson process which employs alcoholic potash as the treating medium. These socks, along with suitable untreated controls, were put into wearing tests at the Quartermaster Board at Camp Lee, Va. The wearing test of these socks has been completed, and the results are all that had ben hoped for. The treated socks had a wear life 60 per cent longer than the untreated control. (See Figure 3.)

Incidentally, in this test, as in previous ones, the untreated controls did not wear out, but rather shrank to an unwearable size after 8 to 16 launderings in the army mobile laundry.

Measurements of shrinkage during the test showed varying degrees of shrinkage for the socks. These are shown on the bar graphs. (See Figures 4 and 5.)

You will note that even the treated socks shrank, but they did not felt, and remained elastic throughout their life. The elasticity enables the socks to stretch to fit the foot without the undue strain which causes rapid wear. I have here a few examples of treated and untreated socks that have been washed together by very severe methods to illustrate the effect that can be obtained with a suitable shrink-resistant treatment. (See Figures 6 and 7.) This illustrates socks, wool, cushion sole and stockings, wool, knee-length (women's), before and after laundering, with and without a shrink-resistant treatment.

With the proof in hand that shrink-resistant treatment of socks can greatly enhance their wearing life, and thereby

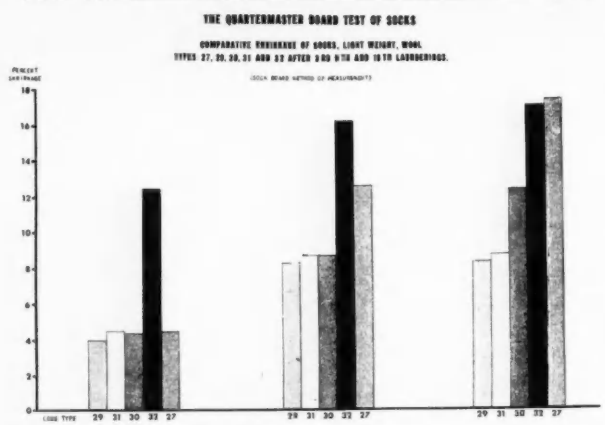
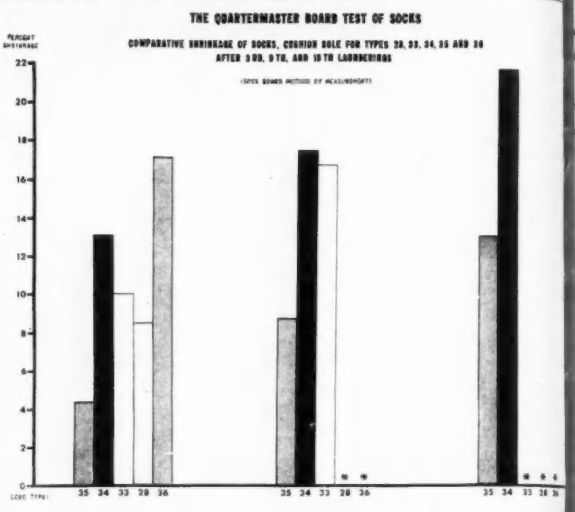

THE QUARTERMASTER BOARD TEST OF SOCKS
COMPARATIVE SHRINKAGE OF SOCKS, LIGHT WEIGHT, WOOL
TYPES 27, 29, 30, 31 AND 32 AFTER 3 RD 9 TH AND 18 TH LAUNDERINGS.
(SOCK BOARD METHOD OF MEASUREMENT)
PERCENT SHRINKAGE
LOOP TYPE
29 31 30 32 27
29 31 30 32 27
29 31 30 32 27

Figure 4. (Above) Left to right—shrinkage after 3 launderings; shrinkage after 9 launderings; shrinkage after 18 launderings.
Type 27—56's to 60's wool, untreated sock, wool, light.
Type 29—60's wool, enzyme treated sock, wool, light.
Type 30—60's wool, chlorinated, sock, wool, light.
Type 31—60's wool, Freney-Lipson treated, sock, wool, light.


THE QUARTERMASTER BOARD TEST OF SOCKS
COMPARATIVE SHRINKAGE OF SOCKS, CUSHION SOLE FOR TYPES 28, 33, 34, 35 AND 36
AFTER 3 RD, 9 TH, AND 18 TH LAUNDERINGS
(SOCK BOARD METHOD OF MEASUREMENT)
PERCENT SHRINKAGE
LOOP TYPE
35 34 33 28 36
35 34 33 28 36
35 34 33 28 36
* * *

* Not measured due to excessive shrinkage of tops of socks

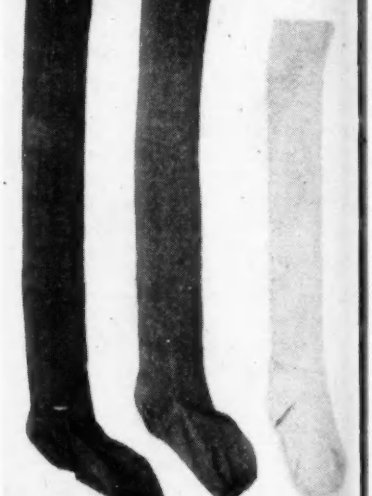
Figure 5. (Right) Left to right—shrinkage after 3 launderings; shrinkage after 9 launderings; shrinkage after 18 launderings.
Type 28—56's to 60's wool, untreated socks, wool, cushion sole.
Type 32—60's wool, untreated, socks, wool, light.
Type 33—60's wool, enzyme treated sock, wool, cushion sole.
Type 34—60's wool, chlorinated, sock, wool, cushion sole.
Type 35—60's wool, Freney-Lipson treated, sock, wool, cushion sole.
Type 36—60's wool, untreated, sock, wool, cushion sole.

decrease the number of socks required by the Army, the next problem was to obtain treated socks from the manufacturers. The American sock industry has never produced large quantities of shrink-resistant woolen socks, and therefore had little or no experience with the methods of treatment and no specifications were available for shrink-resistant rocks in the Army. It was immediately obvious that a three-fold program was necessary to obtain treated socks to realize the value of these findings. First, all possible processes had to be tested and evaluated for efficiency and adaptability to American manufacturing processes. Second, suitable specifications for the control of the quality of the finished product must be developed. Third, the manufacturers must be educated in the application of the desired processes. To implement the work, active projects were initiated in the Office of the Quartermaster General with the close cooperation of the Research and Development Division of the Philadelphia Quartermaster Depot, and using the field testing facilities of the Quartermaster Board at Camp Lee. The National Research Council was requested to sponsor a project on shrink-resistant treatments of wool, and such a project was initiated at the Textile Foundation.

Figure 6. Sock, wool, cushion sole. Left to right—original; treated-washed; untreated-washed.

In the course of preliminary investigations, it developed that one manufacturer had, over the past 12 to 14 years, been applying a chlorination process to a certain part of his production of fine woolen socks, with good results. This process was the same as that which had been used on the socks, wool, light which had been tested at Camp Lee, with good results. It was therefore decided, in order to obtain some degree of resistance to shrinkage in socks, wool, cushion sole to use this process in at least part of the hosiery mills while investigations continued to determine the most suitable processes for general use. Accordingly, demonstrations of this process were arranged as rapidly as possible at those mills making cushion sole socks, which were believed to be equipped and manned to handle the process. As soon as a plant management believed that it was sufficiently familiar with the method of treatment, and there was reasonable assurance that its application would not delay the delivery of socks, renegotiations of contracts were made to provide for the desired treatment. At the present time, more than 50 per cent of the socks, wool

Figure 7. Stocking, wool, knee-length, women's. Left to right—original; treated-washed; untreated-washed.



cushion sole are being delivered with the shrink-resistant treatment.

Concurrently, with the adoption of the one treatment for immediate use, the group at the Textile Foundation, working in the laboratories there, and also in a pilot plant located in the vicinity of the Philadelphia Quartermaster Depot, was studying the many available shrink-resistant treatments to determine which ones would yield satisfactory results on socks, wool, cushion sole.

The study of this group was first concentrated on chlorination processes because of the decision to use a chlorination process on socks currently being delivered. Complete data were kept on time, temperature, rates of reaction and pH. The socks so treated were then returned to the laboratory at the Textile Foundation for evaluation of shrinkage control and chemical analysis to determine possible excessive modification of the wool. I will not attempt to go into the details of the methods used for evaluating the amount of modification which occurred to the wool fibers during treatment, nor will I attempt to give you in detail the results of evaluations of the many different methods tested. However, a brief discussion of the general classes will be of interest.

The treatments examined may be divided into four classes; namely, halogenation treatments, resin treatments, Freney-Lipson process, and enzyme treatments. In general, the following comments may be made about the various types of treatments based on the results of the experimental work which has been conducted by and for the Quartermaster Corps.

The halogenation processes, consisting of many types of chlorination and bromination processes, offer advantages of being applicable in the currently available types of hosiery-dyeing machinery. They are relatively simple and require no special controls during application. They have yielded excellent shrinkage control, and wearing tests have shown that the modification of the wool to control shrinkage can be accomplished without decrease in wearing life. It is, however, well known that excessive chlorination or bromination, which may be brought about in a variety of ways, will greatly increase the alkali-solubility of the wool, cause embrittlement and harshness and generally destroy the wearing properties of the material.

The latest results from the laboratory indicate that a very simple chlorination process yields excellent results on socks, wool, cushion sole. Briefly, this process consists of wetting the socks out thoroughly with any of the synthetic wetting agents which are resistant to chlorine, and then adding slowly, over approximately a 10-minute period, 4 per cent calcium hypochlorite (70 per cent grade), based on the weight of the socks, and previously dissolved in water, and allowing the machine to run for a further 20 minutes. One per cent sodium bisulfite is then added as an anticlor and run for 5 minutes. The socks are then well rinsed and dyed in the usual manner. The entire process, with the exception of the final rinses, is carried out cold, about 75 degrees F. The only control necessary is that the pH of the treating bath should be between 9 and 7.5 during the treatment. The use of a small amount of tetra sodium pyrophosphate added to the last rinse water may be beneficial to the subsequent dyeing process. It should be carefully noted that this process was specifically recommended for socks, wool, cushion sole, and while it may be applicable to other wool items, tests have not as yet been completed to substantiate this point.

Captain Harry F. Clapham, Military Planning Division, Q. M. G. O., received his B.S. in engineering from Rhode Island State College and then spent a year studying in the dyestuff laboratories of the Imperial Chemical Industries and at the Manchester College of Technology in England. Prior to reporting for active duty in the Army he was a technical demonstrator on wool and mixed fibers with the Dyestuffs Division of the duPont company. He has been on active duty at the Office of the Quartermaster General in the Textile Section of the Research and Development Branch for the past twenty-eight months. During that time, he has been engaged with development problems on Army textiles, particularly in the field of dyeing and finishing.

Resin treatments, involving the use of melamine-type resins, which are applied to the wool from water solution, dried and then cured to secure polimerization, have shown promise of producing a satisfactory shrink-resistant finish. For socks, however, the processing is complicated by the fact that adequate curing facilities are not available in the majority of the knitting plants, and for this reason the resins do not appear to offer any advantages for the treatment of socks. They have been used, however, with success for the treatment of wool sleeping bag fabric, and it is probable that they will offer many desirable features for the treatment of other woven fabrics.

The Freney-Lipson process involves the use of an alcoholic solution of caustic potash and an alcoholic solution of CO_2 or other acidic materials and alcoholic rinses. It is obvious that such a treatment will require highly specialized equipment for the handling of alcohol, such as enclosed treating machinery, recovery systems, reactifiers for purifying the alcohol, solvent driers, and the necessary safeguards to prevent explosions or fire. The results of experiments to date have shown extremely good performance for socks treated by this method. In spite of the requirements for specialized equipment, the process appears desirable, especially for treating items which are in the finished form, such as socks, sweaters, and underwear which are already in stock in the depots. This is particularly true since the treatment does not materially affect the color of the finished item, nor does it disturb the press or boarding which has been done during normal finishing operations.

Plant trials of the Freney-Lipson treatment have been carried out under the direction of the personnel of the Philadelphia Quartermaster Depot Research and Development Division on dyed and finished socks. The treatments were carried out in rubber-lined extractors, and although the apparatus was not designed for the purpose, and the loss of alcohol was great, the results as measured by laboratory tests were excellent. Especially interesting was the fact that the color of the socks, even though union dyed, was practically unaffected, and the socks maintained their boarded condition. With proper equipment it would undoubtedly be possible to treat stocks of socks, sweaters, etc., already manufactured and thereby extend their useful life.

The investigations of the enzyme treatments for the prevention of shrinkage have not as yet shown particularly desirable characteristics. In fact, for the amount of shrink-resistance accomplished, the modification of the wool fiber as measured by various available laboratory methods has been considered excessive. It is believed that much can be learned about this process which may develop its usefulness as a treating method.

While it may appear, from what I have just said about the various processes, that all our decisions have been based on laboratory, pilot plant and mill trials, such is not the case. Every process that shows promise in the laboratory and pilot plant has been applied to a large group of controlled socks and sent down to Camp Lee to the Quartermaster Board for field-wearing trials on soldiers in training for the ultimate proof as to the adequacy of the treatment.

Perhaps you would be interested to know something of the methods used in field-wearing trials for evaluating wear-

ing qualities of socks. When any new type of sock is submitted to the field test group for tests, there is also submitted a set of control socks, usually the standard sock in current use. Normally 150 to 300 pairs of socks are submitted when a wearing test is desired. After the socks are received at the field test headquarters, each sock is carefully labelled and a sheet is set up to follow its life history. The test group then makes arrangements with the Commanding Officer of Camp Lee for the use of training regiments as test subjects for the wearing of the socks. The sock size of each man in the regiment is determined, and a representative of the test group supplies him with the pair of socks to be worn. The man is then expected to wear the socks for two days, and at the end of that time he places them at the foot of his bed upon retiring, and the test representative collects the worn socks and replaces them with the control pair. The representative then supervises the laundering of the dirty socks in a mobile laundry unit, using the normal wool formula of the mobile laundry. The socks are then carefully examined for holes and measured for shrinkage. Any hole is considered a failure, and the sock is removed from the test. After laundry and examination, if the socks are still in wearable condition, they are again returned to the soldier for another two-day period of wear, and the cycle is continued until all of the socks have been worn out. The test group then reports on the value of the experimental sock as compared with the standard sock against which it was tested. Particular attention is always called to any unusual failures or any failures which have occurred frequently during the test so that efforts can be made by the research personnel to strengthen weak points of the socks, and thus give them longer life.

The Quartermaster Corps study of shrink-resistant treatment for socks has now progressed sufficiently to permit taking up the study of the shrink-resistant treatment of other woolen materials, and as rapidly as possible every effort will be made to obtain the benefits of such treatment on the other woolen materials used by the army.

DISCUSSION

Wilbur K. Newman: Is the Quartermaster depot still having the sleeping bags treated?

Captain Clapham: At the present time they are not, primarily because of difficulties of procurement, I believe.

. . . Chairman Harris next presented his paper. . . . (Applause)

SOME FACTORS CONTRIBUTING TO THE FELTING OF WOOL*

MILTON HARRIS†, **

INTRODUCTION

IT is well known that when a mass of wet wool fibers is subject to certain mechanical action, the fibers become so entangled that it becomes practically impossible to separate them without considerable fiber breakage. This phenomenon is known as "felting" and the process which results in the formation of the entangled mass of "felt" is referred to as felting, fulling, milling or shrinking. Perhaps no single property of any textile fiber can at the same time be viewed from the standpoint of an industry as either so advantageous or disadvantageous as the property of wool and other hair fibers to felt. On the one hand this property is harnessed to great advantage in the manufacture of such materials as hats, flannels, blankets, clothing, papermakers felts, industrial felts such as gaskets, polishing blocks, and a great variety of other materials. On the other, it is probably the greatest deterrent to the wider use of wool in socks, shirts, or any materials which must be subjected to ordinary laundering procedures.

The present discussion is concerned only with the nuisance value of this property, that is, the tendency of wool to shrink excessively under ordinary laundering conditions. It may be appropriate to point out at this time that the shrinkage of wool fabrics may result from two actions; (1) the relaxation of the fabric, and (2) the actual felting of the wool fibers. The former is a function of the amount of stretch or tension that has been imparted to the yarn during spinning, knitting or weaving, as well as of the structure of the fabric; thus it is small for tightly woven fabrics and high for open fabrics. Treatments which reduce the tendency of wool to felt do not necessarily affect relaxation shrinkage.

The subject of wool felting and its prevention has recently been widely discussed in the literature [1, 2, 3]. There is an abundance of published material dealing with various phases of the subject, much of which describes processes for rendering the fiber shrink-resistant. In general, these include variations of the halogenation, resin, alkali, and enzymatic processes. The present discussion is not concerned with the details of such treatments but rather with the question of why wool felts and how is felting inhibited by the variety of treatments referred to above?

THEORIES OF WOOL FELTING

If the various theories which have been advanced to explain the phenomenon of felting are considered, it is found that the explanation which had gained widest acceptance in the older literature and textbooks is the so-called interlocking scale theory [4, 5, 6, 7]. While, as will be pointed out later, the scaliness or, better, surface friction properties undoubtedly have a role in felting, nevertheless it is not the major factor as indicated in Speakman's studies [8] and as also indicated by the fact that many coarse hair fibers with good scaliness shrink little or only with great difficulty.

Another general theory is that during mechanical action there is a migration of the fibers in the direction of the root end of the fiber [9, 10, 11, 12, 13], the migration resulting from the peculiar surface characteristics of the fiber‡. This is apparently an important factor, but for the same reasons given above, cannot entirely explain the behavior of wool during the felting process.

Still another of the older theories postulates the conversion of the surface of the fibers to a gel state (protogel) which then causes adhesion of the fibers [14, 15, 16]. That this is probably not a factor is indicated by the fact that treatments such as chlorination tend to make the surface of wool more gel-like but at the same time they inhibit rather than enhance felting.

The more recent theories have taken cognizance of the unusual mechanical properties of hair fibers and have especially emphasized the importance of ease of stretching and deformation, as well as possession of the power of recovery after extension [17, 18, 19]. The importance of these properties will be brought out further in the subsequent discussion.

Finally, an explanation which has been occasionally advanced but which appears to deserve more emphasis than it has been given involves the tendency of hair fibers to curl under felting conditions [19, 20]. It

* Presented at Annual Meeting, Atlantic City, N. J., October 14, 1944.

† Director of Research of the Textile Foundation, National Bureau of Standards, Washington, D. C.

** Present address, Milton Harris Associates, 1246 Taylor Street, N. W., Washington 11, D. C.

‡ Work now in progress indicates that the surface properties of hair fibers are profoundly altered by many shrink-resistant treatments.

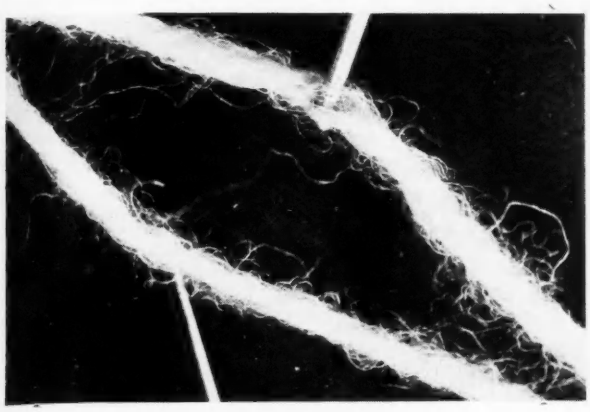


Figure 1—Treated Wool

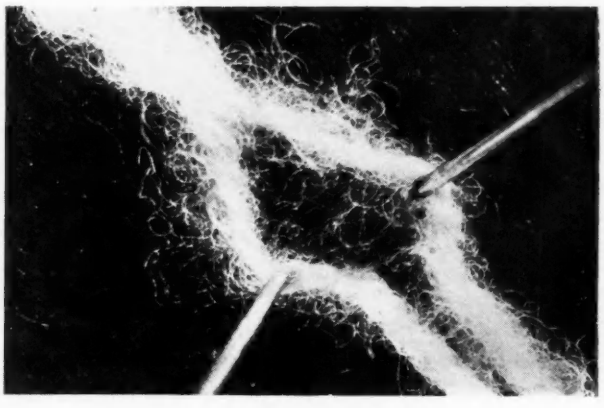


Figure 2—Untreated Wool

is the purpose of this discussion to only consider the possible contribution of this phenomenon to the felting process. The contribution of other fiber properties will be described elsewhere.

THE "CURLING TENDENCY" OF HAIR FIBERS

The importance of this tendency became apparent during the examination of small balls of hair that had formed on the coat of a small cocker spaniel. The balls had all of the characteristics of a felt but owing to the smoothness and strength of the individual fibers, it was possible to tease out individual hairs. Examination of these quickly revealed that although the free hair of the spaniel was very straight, the portions in the balls were in a highly curled state. Similar observations, of course, can be made on a wool felt. The curling and entangling that takes place during felting is strikingly demonstrated* in figures 1 and 2. The former represents a sample of two-ply yarn treated by a shrink-resistant process and then laundered; it will be noted that the fibers show little if any entanglement. In contrast, the untreated yarn, shown in figure 2, is characterized by highly entangled and curled fibers.

This curling tendency was also ingeniously demonstrated by Berg[20] in studies of the felting properties of rabbit hair fibers. Berg's experiments consisted of taking tufts of fibers with and without previous carroting and sealing these in glass capillary tubes filled with water. When the tubes were immersed in boiling water for a few minutes, the untreated fibers did not produce any curling but the carroted fibers readily curled and intertwined with each other. In view of the apparent importance of curling as at least one feature of the felting mechanism, it appears advisable to consider those structural features of a hair fiber which might contribute to this behavior.

It has long been known that a hair fiber is made up of cellular units arranged in three layers: an outer layer of scales (cuticle), a middle region called the cortex, and a center core, or medula[21, 22, 23, 24, 25]. In fine grades of wool, the medulla is either narrow or absent and, in any case, is not believed to contribute appreciably to the mechanical properties of the fibers. For these reasons, it will not be further considered at this time. Although both the cuticle and cortex appear to belong to the same general class of proteins, nevertheless there are certain outstanding differences between them. This is apparent from microscopic, chmical and biological investigations. Thus in recent optical, as well as electron, microscopic investigations, Hock and coworkers[25, 26] showed that over a wide range of magnifications, the fibrous nature of the cortical cells was always evident. The smallest structural units which they observed (microfibrils) appeared to parallel the axis of the fiber and presumably this type of structure persists down to the actual molecules, which according to X-ray analyses, also show a predominant preferred orientation with respect to the fiber axis. In contrast, the scales show little internal organization and even at the highest magnifications, they gave the appearance of a uniform, amorphous mass.

Other lines of investigation also support these conclusions regarding differences in structure. For example, under the polarizing microscope, cortical cells are birefringent, whereas the scales are not[26]; X-ray data indicates a difference in structure between cuticle and cortex[27]; chemical analyses show differences in amino acid composition, the most striking being a much higher cystine content in the cuticle[28]. Finally, striking evidence was recently put forth by Royer and Millson[29] who showed that the ends of fibers, which are not protected by scales, take up dye more rapidly than do the intermediate parts.

There is thus little doubt of a real structural difference between the cuticle and cortex of the fiber and the next question which poses itself is, how is this related to the felting process? To understand this we must refer briefly to some of the well known mechanical properties of wool fibers. Perhaps wool's most distinguishing property is its long range elasticity; that is, its ability to recover from deformations of considerable magnitude. This elasticity is attributed to the fact that the molecules in the cortex are aligned more or less parallel to the fiber axis and, further, when the fiber is in the unstretched state, the molecules are in a folded state[30, 31]. When the fiber is stretched, the molecules tend to unfold and presumably may approach a fully extended form prior to rupturing of the fiber. On release of the stress, the fiber contracts to its original length, a phenomenon which apparently results from a tendency of the molecules to return to a more probable or stable configuration, which is presumably a folded or coiled configuration. If when the fiber is in a state of strain, energy in the form of heat is applied, further contraction may set in; that is, the fiber can contract to a length shorter than the original. This may be interpreted as meaning that the molecules can assume an even more highly folded configuration if they are sufficiently excited.

This contractile "tendency" is not unique with wool—it appears to be a property of any system of flexible molecules, especially those which are oriented and partially or completely extended. It is exhibited by collagen, stretched rubber, vinyon, and nylon, as well as many other

* These photographs were kindly furnished by Drs. Kienle and Royer of the Calco Chemical Division.

systems. All of these systems, given an opportunity, will actually contract or exhibit a contractile tendency. What is meant by given an opportunity? If the temperature is raised two things may occur: (1) the kinetic energy of the molecules is increased, and (2) the attractive forces between the molecules are weakened. Both of these factors will increase the tendency to contract. Swelling agents which increase the distance between parallel chains also increase the contractile tendency.

Thus, it at once becomes apparent that when wool fibers are put in warm aqueous solutions, the tendency of the partially oriented portion of the fiber, which is the cortex, to contract increases. At this point a peculiar situation is encountered—the cortex of the fiber will tend to contract but the cuticle, which has a very different structure, would not be expected to have the same contractile tendency. The result should be that which would be found in a system having different coefficients of expansion and contraction—a behavior such as occurs in a bimetallic strip. In other words, a curling or bending of the fiber might occur.

In order to test this hypothesis, the following qualitative experiment was conducted. The straight portions of rubber bands were extended approximately 50 percent and so mounted between clamps that they could be held in this position. The stretched bands were then coated with various solutions of cellulose acetate in acetone, qualitatively varying the amount of acetate which would remain on the band. The systems were allowed to stand in this state for about 16 hours, after which the bands were released from the clamps. On release of the tension the following behavior was noted. Those bands which were treated in such a way as to leave a thick coat of acetate on the surface remained rigid and in the extended state. Those bands having an extremely thin coating of acetate contracted nearly linearly although there was a tendency to curl in some cases. Finally, those bands which contained intermediate amounts of coating twisted and curled considerably, especially when subjected to mechanical disturbances.

If we assume that a similar phenomenon may occur in wool and other hair fibers, then the following generalization can be made: *The curling tendency will depend on a certain "balance of power" between the cortex and the cuticle.* If the cuticle is thick and strong, the curling tendency will be diminished; if the cuticle is too weak or destroyed, the tendency to curl may also be diminished as contraction may take place more or less linearly. Similarly, if the cortex is strengthened as might be done by adding more cross-links, curling should also be minimized.

Dr. Milton Harris, formerly Research Director, Textile Foundation and Textile Research Inst., national Bureau of Standards, received his B.S. from Oregon State College in 1926 and his PhD. from Yale University in 1929. His graduate work was in the field of protein chemistry and from there he proceeded to industrial research on silk. In 1931 he became a research-associate of the A.A.T.C.C. at the National Bureau of Standards and devoted his time to fundamental research on the chemical and physical properties of the protein fibers, silk and wool; the cellulose fibers, including cotton, rayon, and flax; and the newer synthetic resin fibers such as nylon and Vinyon. In 1938 he became Director of Research of the Textile Foundation and since 1941 held a similar position with the Textile Research Institute, Inc. He is now head of his own organization, Milton Harris Associates, doing research and consulting work.

RELATION OF CURLING TENDENCY TO FELTING

How does this fit into what is known about felting? Coarse fibers in general felt less easily than fine fibers[32] and it is well known that the coarser fibers have thicker, stronger cuticles. In other words, the balance of power is strongly in favor of the cuticle. Similarly, most fur fibers have thick cuticles[33] and at the same time felt with great reluctance. On the basis of the concept proposed in this discussion, carroting treatments*, which increase the feltability of hair fibers, so do by weakening the cuticle sufficiently to throw the right balance of power to the cortex and thus allow the fiber to curl. If the fiber is over-carroted, the feltability of the fiber is reduced, much in the same way that shrink-resistance is accomplished. Creeley and Le Compte[34] have emphasized the similarity between compositions used for carroting and those used for shrinkproofing. From the foregoing discussion it would appear accordingly that the same treatment may enhance or inhibit felting, the difference depending on the degree to which the relative mechanical properties of cortex and cuticle have been altered.

EFFECT OF SHRINK-RESISTANCE TREATMENTS ON "CURLING TENDENCY"

It is interesting to briefly speculate on the possible relation of some of the shrink-resistant treatments to the curling mechanism. Chlorination[25, 35], alkali (Freney-Lipson)[36], and enzymes[37] treatments such as used in producing shrink-resistance are all known to attack the cuticle of the hair fiber or change its surface characteristics. Presumably this would affect such properties as fiber migration but at the same time could influence the curling tendency by changing the balance of power between cortex and cuticle.

From the point of view of curling the newer resin processes could produce shrink-resistance in at least two ways. If the resin polymerized on the surface of the fiber, the cuticle would be strengthened and the balance of power would be in favor of the cuticle. On the other hand, if the monomers used to form the resin were first allowed to penetrate into the fiber and then polymerized, the contractile tendency of the cortex could be decreased; preliminary experiments on the stress-strain properties of resin-treated wool fibers indicate that alteration of these properties does occur.

CONCLUSION

It is not intended to leave the impression that the curling tendency is the sole cause of felting, but rather to emphasize its possible contribution more than has been done in the past. Undoubtedly felting and rate of felting are influenced by many factors and among those listed in the literature are fiber fineness, length, scaliness, swelling, fiber migration, temperature, pH, previous chemical treatment, crimp, wet strength, extensibility or rigidity, recovery from extension, yarn structure, fabric structure, etc. It is apparent therefore that shrink-resistance might be accomplished by affecting one or more of the various factors that contribute to the felting mechanism. On the basis of the foregoing discussion, it appears that one approach to the problem is to alter the relative mechanical properties of cortex and cuticle, either by sufficiently weakening or strengthening either phase so that the normal "curling tendency" of the fiber is minimized.

* It is recognized that in commercial carroting treatments, only the tip portions of the fibers are carefully treated with the carroting agents. It appears that by doing this, an appreciable part of the fiber remains undegraded and thus gives a firmer felt.

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DISCUSSION

Mr. Brommelsiek: Might I ask you a question in regard to the felting? I have never studied it sufficiently, but I feel that it might be possible to attack the problem from another side. In other words, I do not believe that any possible felting action can take place unless the material is in a moist condition. Is there any way of working out the problem whereby the fiber could be more or less water repellent? In this way the entire garment could be kept free from moisture and the felting resisted. Probably another medium than water might be used.

Chairman Harris: I think that there is a little doubt, that if you could completely, so to speak, waterproof a wool fiber, it would felt with great reluctance. I think it is quite necessary, to get good felting, to swell the fiber so that the molecules have sufficient movement to go into these new positions.

Walter H. Jaeger: Is there any evidence of felting in dry cleaning or in any other medium other than water?

Chairman Harris: Theoretically, you shouldn't get felting in dry cleaning, and that is one of the reasons why wool garments are dry cleaned rather than laundered; actually some of these dry cleaning processes have an awful lot of water and soap in them, and you do get a certain amount of shrinkage, although you never get the amount you get in ordinary laundering. I think if you have a really anhydrous system, you would have a hard time getting real felting in a dry cleaning process.

William Steele: Do you believe a simple process, involving three treatments, e.g., (1) a hard soap solution, say, 170 to 180 degrees, (2) manipulation, (3) washing and drying (avoiding a regrading to size as in the case of socks, thereby permitting a major quantity of shrinkage to take place) has any possibility in this particular picture?

Chairman Harris: You mean a preshrinking, so to speak?

Mr. Steele: That is right, a preshrinking by that method.

Chairman Harris: The difficulty is, that when you get to this stage you have a very boardy, uncomfortable sock, that is rigid and undesirable and unmanageable.

Mr. Rider: I agree and feel as you do that this curling is important. However, I feel that it influences mostly the end product of your felting; that is, the density, the elasticity, the strength, and so on. The anchorage of the fibers is necessary. I don't agree, however, that it is primary in the felting operation. You can take mixtures of wool and coarse rabbit hair, cofelt them, and your felting rate will be increased. Certainly, the total percentage of fibers representing this curl has been decreased. The felting rate is accelerated and will go—if you are measuring on an area basis—to a much greater area than a pure wool mixture, chiefly because these fibers are not anchored, and they will leave the felting mass.

So it seems to me that the motion, the directional frictional changes, if you will, and elasticity, are the primary motivating agents of felting, and the curling of the fibers influences what you get as a final product, i.e. how many fibers are lost in the eventual density at a certain percentage reduction.

I would like to have your comments on that, if you will.

Chairman Harris: There are two points there. One is, when you say elasticity is important, I don't think you are saying anything different than I am saying when I talk about contractability.

Mr. Rider: Yes, I mean that.

Chairman Harris: However, I am not sure in my own mind whether we are confusing rate of felting and mechanism. I have been told that mixtures of wool and Aralac felt faster than wool alone. I am sure Aralac doesn't felt in the conventional sense. There are other things that help felting, such as lubrication and ease of movement, but I am not sure that that is fundamental to the basic mechanism.

Mr. Rider: What about this frictional difference?

Chairman Harris: The frictional difference is very important in the sense that you do get some fiber movement. As I pointed out, I did not think that you can entirely explain felting in this way. It is important to hold the felt once you get it.

Mr. Rider: If you could, theoretically, have a mass of fibers—I am asking this simply from an academic standpoint—that had no directional influence but had these other properties, would you say you could felt them?

Chairman Harris: I think so. I believe that if you could produce a fiber with a sufficient structural difference between core and skin and with enough contractual power you could get a material that felts although it would be difficult to predict what quality of felt would be obtained.

Dr. Harold H. Tucker: I would like to ask if in your theory you have taken into consideration the fact that we in the hat business only treat one end of the fiber when we want to increase felting rates.

Chairman Harris: I have never been quite sure of why you do that. You treat it on the pelt, don't you?

Dr. Tucker: There are certain reasons why it is difficult to treat both ends at once, because of the strength of the chemicals used, but nevertheless, even in our experiments, where we have been able to treat both ends of the fiber, we have never been able to get a felting rate that was as fast as we obtained when we treated one end.

Chairman Harris: I will be very happy to take a guess for you, if you want me to now.

Dr. Tucker: I will be very happy to have you take a guess.

Chairman Harris: One of the important features of a hat body is that it must be firm and tough and dense, and it seems that there would be a certain advantage of getting a part of your fiber to lock twist around and hold it tight but have as substantial material as you can have.

Dr. Tucker: We have proven, I think without much doubt, that the quality of the felt as measured by feel and tightness depends a great deal upon the character of the untreated end of the fiber. We would like to keep the untreated end of the fiber in as near its natural condition as possible while we treat the other end and get felting rate increase in that way.

Henry E. Millson: In the early days of Aralac an interesting problem was encountered in the scouring and dyeing of a

50 per cent Aralac—50 per cent wool yarn. It was found that the yarn felted excessively during a normal scouring and dyeing operation. When the yarn was merely immersed in a scour bath containing soap and soda ash at 110° F, removed, and allowed to remain untouched on a truck for several hours, the fibers became felted and the threads in the skein were difficult to separate. This was an unusual example of matting or felting because it had been subjected to little, if any, mechanical action. Our supply of this yarn was limited to one skein and, therefore, we were unable to make further experiments to determine the cause of this unusual felting.

No other Aralac-wool blend has ever shown this effect. It may be that certain chemicals present in the Aralac at that time caused the fibers to felt together without the aid of heat, friction, or other mechanical action.

Dr. Tucker: With regard to mixtures of Aralac and wool, there has been a great deal said about how mixing them increases the felting rate. We have found in some of our work with fur and Aralac, that the initial rate of felting was increased by the addition of Aralac. However, if the felting is carried on, as far as we have to in our type of business, we fail to see where the use of Aralac will result in an increase. In other words, we have no evidence that the use of Aralac results in a decrease in the time that the hat has to stay on the various machines. So that although the initial rate of felting is increased, the overall picture is not changed very much.

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(Continued on Page P80)

FINISHING GROUP MEETING*

D. H. POWERS
Presiding

CHAIRMAN POWERS: Gentlemen, I will call the meeting to order. I am happy to welcome you to a new experiment in the history of the textile industry. This is the first time that we have conducted five technical sessions simultaneously. Next year we hope to have a paper and a rest period, and after that rest period ends you can go to another paper.

This morning we are going to talk about finishing. I will present a resume or review of what has been done in the field of resin finishers over the past two years.

. . . Dr. Powers then presented his prepared paper. . . . (Applause)

NEWER RESINOUS MATERIALS and Their Effects on Various Fibers and Fabrics*

D. H. POWERS

RECENTLY a textile executive remarked that he had not seen a new resin development in the past two years. On the basis of this report there is little to talk about at this time. On the other hand, some research has been going on, but the work has been almost entirely directed toward studying problems arising from the war effort. Actually, this mill, like most textile mills, has been spending almost its entire time and effort in producing fabrics of all types for government contracts. A number of resin problems have been studied, but the majority of these have arisen from the critical shortages of rubber, silk, drying oils, and the like. A careful review indicates relatively little research has been done on new developments for postwar fabrics on account of this demand for improvement in miltary fabrics, but we expect that many of the recent military developments will find a postwar application because they contribute new effects and values.

In the field of resinous materials, two lines of endeavor have been followed: (1) in the field of surface coatings, and (2) in the field of fiber impregnation with resin formers. In the coating field work has been centered on developing satisfactory or superior replacements for natural rubber. In the field of impregnation the new melamine resin types have opened up the entire field of non-shrink woolens and worsteds. Other modifications of these melamine types offer means of stabilizing and shrinkproofing rayons and cottons without many of the dangers of chlorine damage encountered when excessive amounts of chlorine are used in washing and bleaching.

Water dispersions of a wide range of resin types have been developed which show promise for coatings, for more durable and stronger fabrics, and for shrinkproofing certain types of goods, and also for waterproofing. An extremely new and unique resin type is a special polymer of colloidal silica, which is a powerful anti-lubricant and anti-lusterent showing surprising effects on all types of fibers and fabrics. Dispersions of vinyl resin polymers in organic non-solvents show promise for a great many new applications. It is too early to predict accurately the future of the polyethylene condensates, which show excellent electrical properties. Resin bonded roving and sliver is getting a great deal of study, and promises new and surprising yarns.

NATURAL RUBBER

Probably one of the greatest problems has been the replacement of rubber coated and rubberized fabrics with synthetic resins to obtain fabrics with similar properties. While this problem has been solved in the great majority of cases and with great speed, one unsolved case still exists, namely, life rafts of the type dropped from bombers are still fabrics coated with natural rubber. Of course, here there are extremely difficult specifications—the rubberized fabric must be flexible at 80° below zero, and inflate to give a life raft which will age perfectly on the ocean under a tropic sun during weeks of exposure.

The polyvinyl butyrals and the polyvinyl chloride type resins were drafted to replace much of the rubber being used for raincoats and ponchos. While the butyrals were previously used in safety glass, with the cessation of automobile production this product was quickly adopted for Army use. Modifications of the vinyl butyrals gave them properties much closer to rubber, and may enable them to compete with or replace rubber on postwar fabrics.

BUTYL RUBBER

For duplex or two-ply fabrics, butyl rubber appears to be outstanding and gives such good service that it may also hold postwar markets. Its excellent adhesion and its flexibility over a wide temperature range make it more than a substitute for natural rubber, particularly in view of its better aging characteristics.

TENTAGE

Probably the largest volume of resin treated fabrics has been the fireproof, waterproof, mildewproof duck procured by the Army in almost unbelievable quantities. Here the resin became a less important factor, since a very high percentage of filler was required to produce the fire resistant effect. Originally, chlorinated rubber was used as a binder, but the rubber shortage eliminated this product, and a wide range of resins found application, such as polyvinyl chloride, ethyl cellulose, modified alkyds, and modified phenolics, as well as solvent soluble methylol ureas or melamines. The fireproofer has been a combination of highly chlorinated paraffin and antimony oxide. A small amount of calcium carbonate was usually added as a buffer, and copper napththenate as a mildew preventive. Pentachlorphenol was found to be a much more powerful fungicide, but it did not show the permanence of the naphthenate. The poor aging characteristics of the highly chlorinated paraffins have been all too clearly demonstrated in the South Pacific, and it seems likely that many improvements will be neces-

* Presented at Annual Meeting, Atlantic City, N. J., October 14, 1944.

sary to establish these fabrics in the post-war markets.

PONCHOS

Next to tentings, probably ponchos has been one of the biggest markets for resin coated fabrics. Early in the war the trend was from raincoats to ponchos, from cotton to nylon, and from double texture fabrics to single texture garments. Here again, rubber was first used, and it was necessary to swing over to synthetics, particularly the polyvinyl chloride types and the polyvinyl butyrals.

IMPREGNATIONS

There is still a real question as to whether these so-called impregnations owe all of their effects to internal or surface action. In any event, they are all applied under conditions designed to secure maximum penetration, and many of the fabrics treated in this way can be unravelled and the individual fibers removed, indicating no surface coating or cement.

WOOL SHRINKAGE

The newer melamine resins, which can be impregnated into woolens and worsteds, reduce or eliminate the felting of wool, which has always limited its fields of application. It is essential that these new resins be applied in the mill *after* the fabrics have been felted or built up to the proper thickness and fullness. On the other hand, the application of these special resin-former types of melamine makes it possible to felt-proof suiting, shirting, or blanket material to a desired degree and to hold it at this shape in spite of further washings and wearings.

This type of resin may also be applied to knit goods and hosiery for reducing their shrinkage, but the fabrics treated must be dried and cured to shape at 260° to 275° F. Since this is not possible with present equipment in most hosiery mills, it is probable that the old-fashioned, well-known chlorination method will be used on part-wool socks. Care will have to be taken that excessive chlorination under mill conditions does not cause excessive damage. The melamine treated woolens, on the other hand, have frequently shown tensile strength increases as high as thirty per cent.

RAYONS AND COTTONS

A great deal of attention has been given to the launderability of resin treated rayons and cottons. While the urea formaldehyde resins greatly increase the shrinkage, slippage, and muss resistance of rayons and spun rayons, it is also true that they increase the affinity of these fibers for chlorine. They seem to give them more of the properties of wool.

Dr. Donald H. Powers, Director of Sales Development of Textile Chemicals for the Monsanto Chemical Company, Merrimac Division, Everett, Boston, Mass., has degrees from Boston University and Princeton University. He has been research chemist for duPont, chief chemist for the United States Finishing Company, and for about 11 years was in charge of Sales and Research for Textile Chemicals for Rohm & Haas Co., Inc. He is a director of the Textile Research Institute and a member of many Scientific Technical Societies. He is the author of more than twenty-five patents.

On the other hand, the laundry associates point out that if excessive chlorine bleach were used on resin treated rayons, they might be damaged on ironing at a high temperature. In view of the damaging action of chlorine on all types of fibers, it would seem as if its use should be avoided, or at least it should be neutralized with an anti-chlor.

Study of the melamine type resins show that they are tremendously lower in their chlorine adsorption than the urea types and that they cause little tendering of the fabrics even where untreated fabrics are damaged. They seem to exert a protective action rather than a deleterious action on the rayon which is bleached.

The melamine type resins when properly impregnated into the fiber give increasing strength to spun rayon with increasing concentrations. On cotton no loss of strength is encountered even with high concentrations, although little gain in strength is obtained except in the softer weaves. These same resins have found wide application as a durable permanent finish for nylon nettings.

RESIN DISPERSIONS

With the tremendous study of synthetic rubber, which is manufactured as a resin dispersion in water, it is only natural that this type of product should find wider interest and importance for textile application. The dispersions prepared may have a positive or negative charge. The resin may be extremely soft and sticky, or hard and brittle, and the particle size may vary from coarse to just sub-microscopic. The dispersion may consist of pure resin polymer, or it may contain solvents, plasticizers, fillers, pigments, and waxes. Rather than try to discuss each particular dispersion, it may be well to summarize the effects which have been obtained with these products:

Improved wear resistance
Decreased shrinkage
Improved tensile strength
Decreased crocking
Improved fabric coatings
Durable water repellency

While the work on this class of resins has been greatly limited during the war because of demands for the resins for military applications, it seems probable that postwar research will further improve them and widen their scope of usefulness and application.

A related type of dispersion is the resin polymer suspended in an organic non-solvent. While this is a new departure in this field, it offers a great deal of promise. Another development which shows great interest is the recently reported "fiber bonded" yarns. Various type resin adhesives tremendously shorten the time and steps required in producing yarns and twine.

An entirely new development which we like to think of as a resin is the application of special types of polymerized silica dispersions. These products have some film-forming characteristics, and consequently may be classed as a resin, which includes all film-forming polymers. This product called Syton is best described as an anti-lubricant: a drop of it dries up a surface just as a drop of oil lubricates it. It is not at all an adhesive, yet it acts like an adhesive in many cases by increasing the drag and decreasing the slippage. It is effective in surprisingly low concentrations. Less than one per cent solids will greatly alter the hand of a rayon, and will increase the strength of low-twist piece goods as much as twenty to twenty-five per cent. It is adsorbed by the surface of the fiber, and low concentrations appear to be washfast. Perhaps the most striking action of Syton is its effect in increasing the strength of individual fibers where slippage is no longer a factor.

CONCLUSION

While a great deal of work has been done to keep the textile mills in production in spite of shortages, a great deal of research must be completed to insure the full advantages of these developments. Many feel that the rubberized fabrics of prewar will be entirely replaced in the postwar period by the resin coatings developed to alleviate the rubber shortage. Use of urea resins has doubled in the past year for rayon impregnation, and the development of new melamine resins opens up the possibility of non-felting wools, non-shrinking woolens, and stabilized rayons and cottons with greater resistance to the destructive action of the chlorine bleach. The newer resin dis-

persions are just beginning to make their way felt, but they offer many improvements which should justify their wide adoption. In all of these fields it is hoped that a new influx of research effort will help solve the development and application problems that await the postwar period.

DISCUSSION

STANFORD L. HERMANN: I should like further information concerning the dispersion of solvents to avoid the lack of filling agent. That was not clear.

CHAIRMAN POWERS: It is a very vital point. What they do is disperse a resin polymer in a non-solvent; in other words, use a dispersing agent for that work, such as aluminum stearate or metal salts.

MR. HERMANN: I don't quite follow you, because if you are making a water dispersion where does the solvent come in?

CHAIRMAN POWERS: That is an entirely different type of dispersion; in other words, in the case of water dispersion, we disperse the resin polymer in water. In the case of solvent dispersion, one possible procedure would be to dissolve the resin in a solvent and then emulsify that resin solution in solvent in which the resin is not soluble.

MR. HERMANN: Discontinuous phase?

CHAIRMAN POWERS: Discontinuous.

MR. HERMANN: Is that possible?

CHAIRMAN POWERS: That is being done.

MR. HERMANN: What type of equipment is used?

CHAIRMAN POWERS: Oh, it takes a colloid mill.

MR. HERMANN: A homogenizer?

CHAIRMAN POWERS: Homogenizer. The beauty of it is that dispersing agents in the solvent are the metal soaps.

AZEL W. MACK: What place does a cellulose finish have in this program?

CHAIRMAN POWERS: We are discussing resins here. We are not discussing permanent finishes as such. We are discussing resins and their application to textiles. The cellulose ethers are finding a lot of application as a durable finish. On the other hand, I don't think by any definition you could call them resins, but they have some very definite applications.

The evidence seems to show that they do not particularly help resilience or shrinkage, which are of course two basic problems. As a durable finish, there is no question about their durability; you dissolve them in caustic and precipitate them with acid and the only thing they will redissolve in is in caustic.

SIDNEY M. EDELSTEIN: You mention that cellulose finishes don't particularly control shrinkage.

CHAIRMAN POWERS: That is right.

MEMBER: Some of the latest work, particularly the work at Arnold, shows that shrinkage control can be obtained to an extent as good as with any of the resins such as urea formaldehyde. Work on rayon also shows the same thing.

CHAIRMAN POWERS: The point you should clarify is this: In the treatment of that particular material with strong alkali you, of necessity, get shrinkage and, having gotten that shrinkage during the treatment, subsequent shrinkage is greatly reduced; is that right?

MR. EDELSTEIN: No. With the cellulose finishes, not only cellulose ethers, but some of the newer types of alkali soluble finishes they control shrinkage at any particular point.

CHAIRMAN POWERS: I see.

MR. EDELSTEIN: So that it has nothing to do with the alkali.

CHAIRMAN POWERS: I see what you mean.

J. A. CRUMLEY: What effect does the silica application on hosiery have in producing anti-slippage in regard to the Frazier test?

CHAIRMAN POWERS: It does just one thing: It increases the coefficient of friction between the fibers. Theoretically, I suppose a perfect non-slip stocking would be one that you had coated, by dipping it in a benzene solution of rubber. If you coat a stocking after it is made, you make it non-slip in the sense that you lock each thread together, but it ceases to be a stocking and you can't run a Frazier test on it.

In the case of the silica, you can take a stocking and wet it out in the silica and dry it and then cut a hole in it and it won't run, because the friction between the fibers is such. On the other hand, there is no bond, there is no cementing action. It is merely a friction between the fibers.

Of course, on the Frazier test you get the yarns sliding over each other, but the coefficient of friction is increased. Actually, the way to work it out is by compromise and have a certain amount of lubricant for the sake of the slip of the yarn and use a certain amount of Syton and get the dryness. However, you have to give somewhere; in other words, you don't want an actual fiber locking or you will ruin your knit effect.

MR. CRUMLEY: You lose your elasticity.

CHAIRMAN POWERS: That is right.

MR. CRUMLEY: I just wondered whether they would wear any longer from that effect.

CHAIRMAN POWERS: Some types of hose have shown a very appreciable increase in wear. On the other hand, it takes a surface lubricant to help them wear, because if you don't put anything on, obviously, your wear is greatly increased because your coefficient is greatly increased and the energy you put into your wear tests is tremendously greater.

MR. CRUMLEY: You have to hit the proper balance there.

CHAIRMAN POWERS: That is right.

A. H. GAEDE: I would like to ask in relation to lubrication of almost any type of material treated with silica, for example, yarns: what type of lubricants will be effective without destroying entirely the cohesion effect. Don't you frequently come back, when you lubricate them, to where you started?

CHAIRMAN POWERS: Not necessarily. We first ran into that problem with wool oils on wool. You see, water dispersions of a wool lubricant, mineral oil, or olive oil, seem to give us a coarse emulsion, whereas the silica particle size is a fraction of a micron. So there you seem to get the silica to go into the fiber and you get an over-all effect of your lubricant on the surface and the two don't oppose each other if you use, as we describe it, a coarse lubricant emulsion and have the silica in the water phase of that emulsion.

FREDERIC DANNERTH: Dr. Powers, would it be fair to say that anything that tends to stop the rubbing of fibers against each other and so prevent slippage would tend to increase the abrasion of the fiber.

CHAIRMAN POWERS: Unless you stop slippage entirely.

MR. DANNERTH: I am speaking specifically of silica.

CHAIRMAN POWERS: That is right.

MR. DANNERTH: We would be treading on soft ground there, wouldn't we?

CHAIRMAN POWERS: Until such point thtat we stop slippage entirely. Then there is no wear.

The remainder of the papers presented at the Finishing Group Meeting will be published in the next issue.

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(Continued from Page P76)

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Elford L. Wingo—Overseer of Finishing, Pacific Mills, Lyman, S. C. Sponsors: R. E. Rupp, W. M. Shanklin.

Ernst A. Wolff—Research Chemist, Merck & Co., Inc., Rahway, N. J. Sponsors: W. F. Fancourt, 3rd, C. Baeringer.

Samuel B. Wood—Supt. of Dyeing, Paton Mfg. Co., Sherbrooke, Que., Canada. Sponsors: J. S. Lange. A. E. Raimo.

T. J. Wrcoklage—Mgr., Bulk Soap Dept., Procter & Gamble Distributing Co. Cincinnati, Ohio. Sponsors: W. B. Tucker, J. B. Crowe.

Justin Zender—Director of Biological Research, Gallowhur Chemical Corp., New York, N. Y. Sponsors: J. D. Dean, W. D. Appel.

Frank Zimmerman—Supervisor, Oscar Heineman Corp., Chicago, Ill. Sponsors: A. T. Brainerd, J. G. Stott.

George Zinzalian—Research Director, E. F. Drew & Co., Boonton, N. J. Sponsors: H. B. Dohner, C. W. Thomas.

JUNIOR

Jack Epelberg—Supt., Chemical Process Dept., Research & Develop. Div., Cluett, Peabody & Co. Troy, N. Y. Sponsors: L. S. Lang, W. H. Hariss.

Mary Erban—Asst. Lab. Director, Monomac Spinning Co., Lawrence, Mass. Sponsors: L. C. Gagnon, F. J. Rizzo.

James J. Gordon—Lab. Asst., American Woolen Co., Andover, Mass. Sponsors: A. W. Morrison, E. E. Fickett.

John M. Gould—Plant Chemist, Barre Wool Combing Co., Ltd., South Barre, Mass. Sponsors: R. G. Riley, C. Byron.

Pauline E. Keeney—Instructor of Textile Research, Pennsylvania State College, State College, Pa. Sponsors: P. B. Mack, F. Bonnet.

Gertrude A. Lathrop—Textile Chemist Alexander Smith & Sons, Yonkers, N. Y. Sponsors: A. G. Ashcroft, R. C. Allison.

Maurice I. Leavitt—N. E. Repres., Textile Div., S. C. Johnson, Inc., Boston, Mass. Sponsors: G. B. Stackpole, A. E. Raimo.

Dorothy S. Lyle—Instructor of Textile Research, Pennsylvania State College, State College, Pa. Sponsors: P. B. Mack, F. Bonnet.

Guillermo Marti—Chemist, Central Textil, S. A., Mexico, D. F. Sponsors: W. D. Baird, F. F. Kraft.

Harold E. Meunier—Instructor, U. S. Army Air Force, Taunton, Mass. Sponsors: A. H. Grimshaw, A. C. Hayes.

Frances K. Ray—Instructor in Textile Research, Pennsylvania State College, State College, Pa. Sponsors: P. B. Mack, F. Bonnet.

Roger G. Stevens—Lab. Asst., Nashua Mfg. Co., Inc., Nashua, N. H. Sponsors: J. W. Russell, H. N. Logan.

Emilio J. Troianello—Chemist, Stamford Res. Labs., American Cyanamid Co., Stamford, Conn. Sponsors: J. M. Hood, A. D. Nute.

ASSOCIATE

Thomas H. Baylis—Salesman, Phillip Brothers, Providence, R. I.

Silas Besthoff—Vice Pres., Faesy & Besthoff, Inc., New York, N. Y. Sponsors: J. P. Bauer, W. H. Espelin.

Leroy A. Blaisdell—Chemist, Kelco Co., New York, N. Y. Sponsors: H. B. Dohner, B. C. Bond.

Joe Carmony—Lima, Ohio.

John B. Cleaveland—Vice Pres., and Director of Research, Cleaveland Lab. & Mfg. Co., Inc., Peapack, N. J.

Rudolph Dane—Sales Repres. L. Sonneborn Sons, Inc., New York, N. Y. Sponsors: J. B. Neely, L. G. Atkins.

William T. Eveleth—Chemical Engr., General Electric Co., Schenectady, N. Y.

George A. Farley—Chemist, Guelph Carpet & Worsted Spinning Mills, Guelph, Ont., Canada.

Moses I. Feuerstein—Treas. & Gen. Mgr., Malden Spinning & Dyeing Co., Inc., Malden, Mass.

Fred J. Gerish—Member of Firm, Agrest Dyeing Co., Inc., New York, N. Y.

George A. Goulston—Treas. & Salesman, George A. Goulston Co., Scituate, Mass. Sponsors: T. W. Shoesmith, J. B. Quig.

Karl W. Hartmann—Vice Pres., E. F. Drew & Co., Inc., Boonton, N. J. Sponsors: A. E. Raimo, C. W. Thomas.

Walter S. Howard—Chemist & Asst. Supt., Delany & Co., Inc., Philadelphia, Pa.

Dolarrai R. Koya—Dyestuff Salesman & Jobber, Bombay, India.

J. K. Martell—Technical Salesman, Kelco Co., New York, N. Y. Sponsors: H. B. Dohner, B. C. Bond.

Warley L. Parrott—Patent Counsellor, Charlotte, N. C. Sponsors: L. G. Atkins, J. Crist.

William H. Randolph, Jr.—Southern Sales Mgr., A. E. Staley Mfg. Co., (Decatur, Ill.) Atlanta, Ga. Sponsor: W. B. Griffin.

Thomas J. Rasmussen—Chemist, Resin Insulation Materials Div., General Electric Co., Schenectady, N. Y.

Charles G. Schultze—Repres., E. F. Houghton & Co., Charlotte, N. C. Sponsors: S. P. Schwoyer, H. G. Miller.

Albert C. Shuman—Research Chemist, Central Labs., General Foods Corp., Hoboken, N. J. Sponsors: C. Baeringer, A. E. Raimo.

George R. Tjaden—Hoffman Tape Mills, Philadelphia, Pa. Sponsors: J. P. Conaway, J. P. Catalino.

Walter B. Warren—Mgr., Warren Soap Mfg. Co., Inc., Cambridge, Mass.

STUDENT

Tahsin S. Ciftci—Gr. Student, Mass. Institute of Technology, Cambridge, Mass. Sponsor: E. R. Schwarz.

Irwin A. Frish—Georgia School of Tech. Sponsor: C. A. Jones.

Leon R. Hodara—Student, Mass. Institute of Technology, Cambridge, Mass. Sponsor: E. R. Schwarz.

Mauricio Kibrick—Mass. Inst. of Tech. Sponsor: E. R. Schwarz.

Han Tang Liu—Student, Mass. Institute of Technology, Cambridge, Mass. Sponsor: E. R. Schwarz.

Tan Chi Lu—Mass. Inst. of Tech. Sponsor: E. R. Schwarz.

Manuel Ramdu Llaguno—Mass. Inst. of Tech. Sponsor: E. R. Schwarz.

Newton W. Mandel—Student, N. C. State College, Raleigh, N. C. Sponsor: A. H. Grimshaw.

Sidney Milgrim—Student, Lowell Textile Institute, Lowell, Mass. Sponsor: E. E. Fickett.

Archavir Nalbandian—Student, Lowell Textile Institute, Lowell, Mass. Sponsor: E. E. Fickett.

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MEETING, RHODE ISLAND SECTION

THE Rhode Island Section held its January meeting on the 26th. The Chairman, H. B. Sturtevant, called for order at 8:15 P.M. and after a few remarks introduced the speaker, Kenneth C. Everett, Chemist, Powdrell & Alexander, who talked on "Testing Mildew Resistance in the Plant Laboratory." After reviewing the nature of mildew briefly and mentioning the several substances most commonly used now to inhibit its growth, he told of how he collected and made apparatus to test the resistance of textiles treated in the plant, devoting most of his attention to the pure culture method. Several colored slides helped to visualize some of the steps. A question-and-answer period followed and a rising vote of thanks to the speaker closed the program at about 10 P.M. The attendance was 70.

Respectfully submitted,
Robert W. Joerger, *Secretary*

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PIEDMONT SECTION CANCELS WINTER MEETING

THE Piedmont Section has cancelled plans for the meeting previously scheduled to be held in Greenville, South Carolina, in February.

The officers of the Piedmont Section concluded that it was inexpedient to try to hold the meeting as planned, because of the congested traffic and overtaxed hotel facilities, and in compliance with the request of the O.D.T. to eliminate large gatherings during the present emergency.

Tentative plans are being considered for a meeting in May, providing conditions are favorable at that time.

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MEETING, PHILADELPHIA SECTION

A MEETING of the Philadelphia Section was held on Friday evening, January 12th, 1945, in the Mirror Room at the Hotel Philadelphian.

Boyce C. Bond opened the meeting and introduced the new chairman, Arthur W. Etchells.

The meeting was turned over to Mr. Etchells, who introduced the speaker of the evening, J. D. Bettridge, who talked on "Fiberglas." A copy of his talk will appear in the *Dyestuff Reporter*.

There were 153 present for the meeting and 135 for the dinner.

Respectfully submitted,
A. E. Raimo, *Secretary*

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MEETING, NEW YORK SECTION

A MEETING of the New York Section was held at the Downtown Athletic Club, 19 West Street, New York City, on Friday evening, January 12th, 1945.

A number of the members of the national council and research committee were present at the meeting.

It was voted to have the secretary poll the members of the New York Section by mail to determine whether they preferred to hold future meetings with or without a dinner. Carl Z. Draves and Patrick J. Kennedy were appointed tellers.

Kenneth H. Barnard, councilor representing the New York Section, reported that the Council had voted not to have an annual meeting this year but the Intersectional Contest will be continued.

Dr. Louis A. Olney, President Emeritus and Chairman of the Research Committee, gave greetings to the section on behalf of the national officers. He complimented the section on the success of its corporate membership drive.

Commander W. F. Prien, chairman of the Technical Program committee, reported that the next meeting would be held on March 16th and that the subject would be "Recent Developments in Finishing and Their Application to Fabrics." Speakers will be Captain Goodavage and Messrs. Ackley and Nute.

The technical program consisted of a symposium on Recent Developments in Dye Application and Their Use in Textiles." Speakers were: Dr. Paul L. Meunier, E. I. duPont de Nemours & Co., Inc., "The Pad-Steam Continuous Process"; Paul J. Choquette, General Dyestuff Corp., "Recent Developments in the Dyeing of Synthetic Fabrics"; Henry E. Millson, Calco Chemical Division, American Cyanamid Co., "Current Aspects of Interest in Wool Dyeing."

The attendance was about 350.

Respectfully submitted,
Norman A. Johnson, *Secretary*.

CALENDAR OF COMING EVENTS

Meeting, Rhode Island Section, Providence Engineering Society Hall, 195 Angell Street, Providence, R. I., February 23, 1945. The March meeting will be held on March 23rd rather than on March 30th as originally scheduled.

Meeting, Philadelphia Section, February 23, 1945.

Meeting, Northern New England Section, March 16, 1945

Meeting, New York Section, Downtown Athletic Club, New York City, March 16, 1945. Symposium on "Recent Developments in Finishing and their Application to Fabrics." Speakers will be Capt. Goodavage and Messrs. Ackley and Nute.

Meeting, Council, Providence Engineering Society Hall, 195 Angell Street, Providence, R. I., March 23, 1945.

Meeting, Research Committee, Providence Engineering Society Hall, 195 Angell Street, Providence, R. I., March 23, 1945.

OTHER ASSOCIATION MEETINGS

Meeting, Committee D-13, A.S.T.M., Park Central Hotel, New York City, March 7th to 9th, 1945.

Meeting, A.A.T.T., Builders Club, New York City, March 7th, 1945.

• M.I.T. DEDICATES NEW TEXTILE RESEARCH LABORATORY

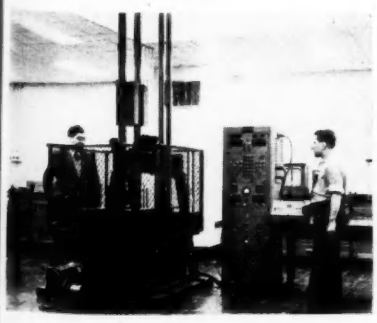
The Massachusetts Institute of Technology announces the establishment on January 3, 1945, of the Samuel Slater Memorial Research Laboratory. Presented to the Massachusetts Institute of Technology by H. Nelson Slater, now serving as a commander in the U. S. Navy, the Laboratory was accepted on behalf of the Corporation of the Institute and of the Textile Division by Dr. Karl T. Compton, president of M.I.T., at dedication ceremonies attended by members of the Corporation, administration and faculty of Technology, and by representatives of S. Slater and Sons, Inc., and invited guests.

Professor E. R. Schwarz, in charge of the Textile Division, outlined the purpose of the Laboratory and the research program to be carried on therein. He pointed out that because of its unique electronic equipment the Laboratory would pioneer in textile research as Samuel Slater had pioneered in textile manufacturing when he built the first cotton card and spinning frames in 1790, and established the first cotton mill in the country at Pawtucket, R. I. One hundred and sixty-five years later, the Samuel Slater Memorial Research Laboratory takes up the problems associated with the load-deformation-time-temperature and humidity relationship in fibers, yarns, and fabrics by means of new apparatus involving the application of electric strain gages, high-speed photography, and the use of such modern devices as the oscillograph and the photoelectric potentiometer recorder.

With this equipment, it now becomes possible to apply to a textile specimen a load of a fraction of a gram for periods of many hours and to record the resulting deformation or to apply many hundreds of pounds to the specimen in less than .001 of a second, still recording precisely the load-deformation behavior.

For this latter work, impact testers have been constructed (See Fig. 2) in

Figure 2



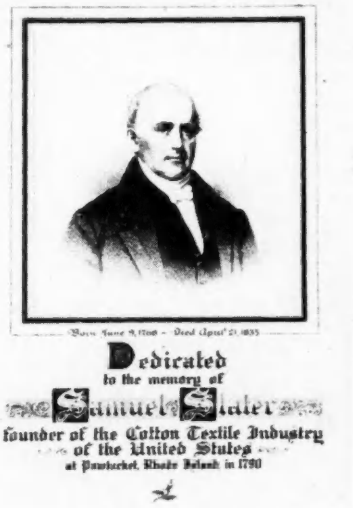


Fig. 1—Dedication Plaque

which either a 25-lb. weight or a 500-lb. weight can be allowed to fall from a height of many feet to cause failure of the sample under shock load. The results of the test are obtained from an electric strain gage, the signals from which are amplified and registered on the fluorescent screen of an oscillograph. A specially designed, high-speed camera makes a record of the motion of a luminous point on this screen on a strip of film. The latter can be projected to give a tremendously enlarged image of the complete load-deformation curve and the measurements of deformation, load, and energy can be conveniently and precisely made.

The machine, including the special shock absorber base, weighs several tons and is guarded electronically for safety and operated by electronic controls from specially designed and built control panels utilizing a number of relays, vacuum tubes, and other electrical equipment. Similar principals of operation are being applied to testing machines running at more nearly the conventional speed for testing textiles and thus eliminating effects of friction, delay, and inertia, which are present in most of the usual testers and which produce graphic records more often recording the vagaries of the machine than the true behavior of the textile material under test.

Typical of this development work is the improved autographic recording compressional resilience tester (Fig. 3) which, by means of a specially designed cantilever support for the sample and suitable electric strain gages, gives a continuous chart of cyclic operations on a photoelectric potentiometer recorder. Publications in preparation by the M.I.T. Textile Division staff will appear regularly from the Samuel Slater Memorial Research Laboratory and will describe the equipment and the results obtained in detail.

The Laboratory is maintained under closely controlled conditions of relative humidity and temperature by a newly-designed system of heating, refrigeration, and humidification; is acoustically treated; and is equipped with the latest design of laboratory furniture and accessories. It is an active and continuing memorial to a great textile pioneer and a fitting tribute in these times to the genius of Samuel Slater.

• PHILADELPHIA TEXTILE GRADUATION AND ALUMNI MEETING

The first mid-year commencement of the Philadelphia Textile Institute was held on the afternoon of February 1st. Degrees of Bachelor of Science in Textile Engineering were awarded to: Harold Ashpitz, Brooklyn, N. Y.; Max T. Grunstein, Mexico; Gaspar N. Cadi, Chile; Jose M. Tabachnik, Mexico. Diplomas were awarded to: Albert L. Balp, Mexico and Fernando R. Tavolara, Peru. H. Wickliffe Rose, American Viscose Corp., delivered the commencement address.

The annual alumni meeting and dinner was held in the evening at the Bellevue-Stratford Hotel. Col. Thomas W. Jones, chief of Procurement, Philadelphia Quartermaster Depot, spoke on "Problems Relative to Procuring Textiles for the Armed Forces." Clarence Ederer, of Ederer, Inc., presided at the meeting. Millard D. Brown, of Continental Mills, spoke on the program of the Textile Institute Foundation and its drive for $2,000,000. A number of military personnel were guests at the meeting.

Figure 3

● ACS MEETING CANCELLED

The annual Spring meeting of the American Chemical Society will not be held in 1945, it is announced by Dr. Charles L. Parsons, Secretary of the Society, following action by the board of directors.

● NEW EASTMAN YELLOW

Tennessee Eastman Corporation, Kingsport, Tennessee, announces a new yellow in its LF series, dyestuffs said to possess exceptional fastness to sunlight.

The new dye, Eastman Fast Yellow 4RLF, produces bright golden shades of yellow on cellulose acetate rayon. In pastel shades, twenty-five- to forty-hour light fastness is said to be obtained; and, of the fast-to-light acetate yellows, this dye is said to be one of the fastest with respect to washing. High resistance of dyed pieces to sublimation and perspiration is also claimed.

Eastman Fast Yellow 4RLF dyes over temperatures ranging from 160° F. to 190° F. It leaves cotton and viscose white and is suitable for cross dyeing. It is highly recommended by the manufacturer for the dyeing of drapery and other fabrics which require extreme fastness to light and gas fading.

● STANDARDS COMMITTEE

A committee of eight industrial executives with Charles E. Wilson, President of the General Electric Company as Chairman, has been appointed by the Secretary of Commerce to advise the Department of Commerce and the American Standards Association on future plans for standards work. This appointment is the first action to come out of a conference of 50 business leaders held in New York on January 12 at the invitation of the Secretary of Commerce to make recommendations to him in regard to the relative roles which should be played by Government and industry in standards activities.

Serving with Mr. Wilson on the committee are:

Frederick M. Feiker, Dean of Engineering, George Washington University; Clarence Francis, Chairman of the Board, General Foods Corporation; Ephraim Freedman, R. H. Macy & Company, Inc.; Frank B. Jewett, President, National Academy of Sciences; William B. Warner, President, McCall Corporation; Arthur D. Whiteside, President, Dun & Bradstreet, Inc; R. E. Zimmerman, Vice-President, U. S. Steel Corporation.

The conference, presided over by Wayne C. Taylor, Under Secretary of Commerce, recommended that industry should provide a strong leadership in the development of national standards and that this should be done in full cooperation with the Government.

● TEXTILE RESEARCH INSTITUTE ACTIVITIES

Decision to place major emphasis during 1945 on fundamental and applied research and the publication of a scientific journal was reached at a meeting of the board of directors of Textile Research Institute, Inc., held Jan. 19. This and other action growing out of the work of the special survey committee appointed last Fall have been reported by the board to the members in a letter just mailed.

After careful consideration the board moved that the present program for applied research be pursued vigorously and expanded; that the building at Princeton be made ready at the earliest possible moment for occupancy by the Textile Foundation Research Group and by institute research workers; and that the magazine *Textile Research* be transformed immediately into a scientific journal. It also moved that the economic research and graduate training be pursued to the extent that funds are available.

The report to the members stated that the committee's studies and the Board's action were necessarily affected by the resignations of Fessenden S. Blanchard and Douglas G. Woolf, president and first vice-president, respectively, who will remain with the Institute until June 30, 1945.

Because of these resignations, the Board appointed Vice-President Harold DeWitt Smith as president.

The affairs of the Institute will be conducted by a plan which will afford each department a large degree of freedom, with the aid of an administrative department to serve the operating departments and handle the general administrative detail. Under this plan Dr. Henry Eyring will continue in charge of fundamental research; Giles E. Hopkins will continue in charge of applied research; Julian S. Jacobs will be in charge of publications; Mr. Woolf will devote his entire remaining time to the guidance of the present economic study; Major D. B. MacMaster will handle the details of office management and personnel; and Mr. Blanchard will devote his to membership work.

● FIFTH ARMY-NAVY "E" AWARD

The Hooker Electrochemical Company, Niagara Falls, N. Y., has for the fifth time won the Army-Navy Production Award for outstanding service in the production of war equipment.

Under Secretary of War, Robert P. Patterson, said in his letter of Jan. 1[3], 1945 to the men and women of the Hooker Electrochemical Company, "You have maintained the fine record which brought you distinction, and your standard of practical patriotism is one of which you may well be proud."

Chronology of Army-Navy Production Awards to the Hooker Electrochemical Company, Niagara Falls is as follows:

"E" Flag—(Sept. 8, 1942), First White Star—(May 8, 1943), Second White Star—(Dec. 4, 1943), Third White Star—(June 24, 1944), Fourth White Star—(Jan. 13, 1945).

In addition to these awards to the Niagara Falls Plant, the Tacoma, Washington Plant of Hooker Electrochemical Co. was awarded the Army-Navy "E" Flag on Jan. 9, 1945.

● TO TEACH TEXTILE CHEMISTRY

Ludwig Fusser, of General Dyestuff Corp., has been appointed successor to Arne K. Gyzander, who has been teaching the course in Textile Chemistry at Columbia Evening Textile Courses since 1938. Mr. Gyzander has resigned and Mr. Fusser took over on February 9th, when the new Spring course began. This course is devoted principally to a study of the various classes of dyestuffs and their application to the different textile fibers and the newer synthetic fibers including nylon, their relative fastness to the common color destroying agencies and the factors that determine the proper selection of dyestuff for raw stock, yarn and piece goods. A survey of such finishing operations, such as water proofing, mildew proofing, flame proofing, crease proofing, etc., is included. The course extends over 15 weeks and includes Laboratory work on alternate lecture periods. Registration for this and other evening textile courses began on January 31st.

● DYEING O. D. 7 ON NYLON

A report of the technical task committee appointed July 7, 1944 to develop new methods for the improved dyeing of nylon fabrics in the O. D. No. 7 shade with respect to light and wash fastness, was discussed and accepted by industry and Government representatives at a recent meeting of the Dyestuff Manufacturers Industry Advisory Committee, the War Production Board has reported.

The task group was called into action by WPB's Dye and Finishing Branch at the request of the Office of the Quartermaster General to devise a method of dyeing nylon of the same fastness properties as obtainable by vat dyestuffs on cotton fabrics for the purpose of satisfying

the various military uses to which nylon fabrics are subjected. The committee consisted of four representatives of dyestuff producers and six representatives of finishing plants.

Recently the Army and Navy designed nylon fabrics for outdoor use in all kinds of climate, which necessitates that the coloring have the best possible fastness to light and washing. The common method for dyeing nylon has employed acetate colors, but fabrics dyed with this class of coloring matter while possessing moderate light fastness were not resistant to washing. Consequently, long before the fabric itself wore out, its color faded to a shade unusable for military purposes, Army officials stated.

To accomplish the desired results two problems were involved: (1) the specific dyestuffs which could be used, and (2) the method of practical application. Confident that their research will solve the Army's requirements in the dyeing of nylon, the committee advocated two specific methods: (1) the pad-steam method with chrome and acid colors, and (2) the pad-jig or straight jig method using pre-metallized colors.

The Office of the Quartermaster General has indicated that it is prepared to accept the methods of dyeing outlined in the report and will soon revise its specifications to obtain the degree of fastness made possible by the new combinations. Representatives of the Quartermaster General's Office said that a new color standard based on the improved fastness possibilities of the new method would soon be selected, but that it would be left up to the finisher to determine for himself which method of processing he will use. However, until such new specifications are prepared and issued, the acetate dye samples now regarded as standard will continue to be used, Army officials said. It is expected that the report will soon be publicized for the use of industry in general.

The committee also discussed the overall chemicals supply situation and the revised first half 1945 military requirements with respect to Chemical Warfare Service smoke dyestuffs, the Army wool program and vat colors for cotton procurements. The discussion considered the available coloring matters for each program, present facilities and availability of the necessary intermediates for manufacturing the dyes.

● APPOINTED A. A. P. MANAGER

American Aniline Products, Inc., on January 1st, 1945 appointed Earl K. Bush manager of the Providence Branch, located at 171 Pine Street, Providence,

Earl K. Bush

R. I. Mr. Bush is well known throughout the textile industry.

Mr. Bush was for many years employed as technician and dyeing superintendent of Printing and Finishing Plants, subsequently joining the staff of the American Aniline Products, Inc. in New York. About eight years ago he was transferred to the New England district as a technical representative and ultimately as a sales representative.

The providence quarters of the American Anline Products have been recently enlarged with new facilities and technical assistants, all of which will be under the direct supervision of Mr. Bush.

● THIOPHENE AVAILABLE

Unexplored fields in chemistry—especially in the plastics, pharmaceutical and dyestuffs industries—are expected to be opened up as a result of an inexpensive method developed by the Socony-Vacuum Oil Company, Inc., for producing thiophene from petroleum, it has been announced by Wilbur F. Burt, Vice-President in charge of manufacturing.

"Previously priced at $54.00 per pound —too expensive for extensive use—thiophene can now be produced by Socony-Vacuum at a cost estimated to make it commercially attractive," Mr. Burt said. "The use of thiophene should have far-reaching results in many phases of industries using chemicals."

Examples mentioned by Socony-Vacuum are that thiophene may alter the elasticity, brittleness, hardness and other properties of plastics, the color of dyestuffs and the physiological effects of medicinals.

Under suitable reaction conditions, thiophene also reacts with aldehydes, particularly formaldehyde, to form thermosetting resins. In this respect, the behavior of thiophene may be likened to that of phenol in the preparation of thermosetting resins of the phenol-formaldehyde type, although there are important differences. Nevertheless, in the condensation of phenol with aldehydes, under suitable reaction conditions, it is possible to replace phenol with thiophene in any proportion.

Socony-Vacuum plans to make samples of thiophene available to serious investigators in order that its potentialities may be explored.

● SAVES BLEACHING CHEMICALS

Burkart-Schier Chemical Company, Chattanooga, Tennessee, has, in cooperation with several mills, developed a method of conserving and extending peroxides which, it is claimed, enables mills to get the maximum poundage of white goods from every pound of bleaching agent consumed.

This method is predicated on the theory that "a good bleach lies in the bleach bottom." A thorough pre-scour with Burk-Schier PSXX and alkali is given, followed by controlled rinsing.

It is stated that it is often possible to obtain the usual volume of full satisfactory whites on reduced supplies of peroxides, using the procedure involved. It is applicable to cotton, rayon and wool.

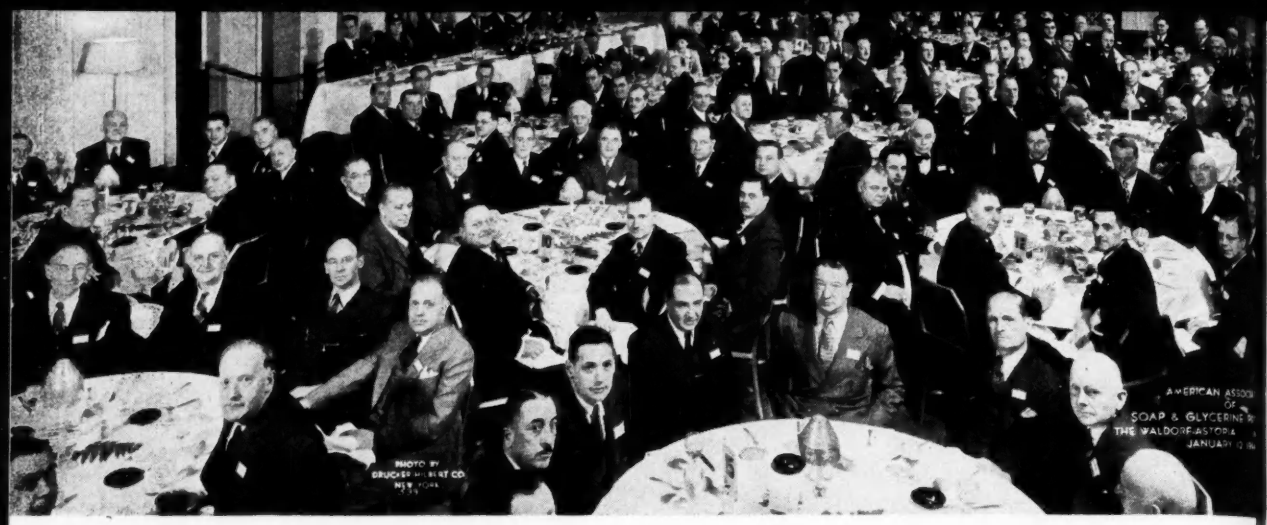
● ANNUAL MEETING, A. S. & G. P.

Officials of the War Food Administration and Office of Price Administration who attended the annual meeting of the Association of American Soap & Glycerine Producers in New York on January 12 thanked the industry for its success in maintaining the supply of its products under the handicaps of war economy. "The military uses of glycerine," said Lee Marshall, WFA's Director of Distribution, "industrially, from a medical standpoint and as munitions and protective coating components—are well recognized. Yet, despite large glycerine requirements, the production of this item has reached such proportions that all orders (regulations) affecting its production were cancelled several months ago.

"As a matter of record, the total number of restrictive orders within the Fats and Oils Branch of the War Food Administration has been reduced about 75 per cent. And I can assure you that other restrictive orders will be cancelled just as soon as such action can safely be taken."

E. H. Little, President of the Colgate-Palmolive-Peet Company, who was re-elected President of the Association, thanked the government representatives for their cooperation.

Other government representatives who gave the soap and glycerine makers frank advice about the relationship of their industry to the war effort were: William H. Jasspon, Fats and Oils Chief, W. A. McConlogue, Soap and Glycerine Chief, both of WFA, and Robert G. Deupree, Head of the Drugs, Soaps and Cosmetics



Section of OPA. Roscoe C. Edlund, manager of the Association, who joined President Little in giving the government representatives a picture of the war activities of the industry, stressed in particular the efforts which the Association and the individual soap advertisers are making to prevent the waste of soap in household uses.

Other officers re-elected in addition to Mr. Little were N. S. Dahl, of the John T. Stanley Co., treasurer; H. F. Elberfeld, of Colgate-Palmolive-Peet Co., assistant treasurer, and Roscoe C. Edlund, manager of the Association, secretary. The following vice-presidents were elected: F. A. Countway of Lever Brothers Co. for the East; E. A. Moss of Swift & Co. for the Middlewest; and F. H. Merrill of the Los Angeles Soap Co. for the West. Two new directors were elected: H. F. Bernhard of the Pioneer Soap Co. of San Francisco, and C. E. Bertolet of the Laurel Soap Co., Philadelphia.

• NATIONAL CARBON BOOKLET

National Carbon Co., Inc., 30 East 42nd Street, New York 17, has recently issued a bulletin, Catalog Section M-8000-A, entitled "'National' and 'Karbate' Carbon and Graphite Products." This 20-page booklet describes and illustrates a wide variety of carbon, graphite and "Karbate" products manufactured by National Carbon for use in the chemical, metallurgical, mechanical, electrical and other industries. The products are presented in sequence as applying to each of these industries and there are many charts and tables covering the physical and chemical properties, together with application and operational data on these products.

• HERCULES BOOKLET

A new booklet listing Hercules chemicals, industrial explosives and approximately fifty industries which they serve has been issued by Hercules Powder Company. In a manner designed for easy reference, the products are first indexed according to various industries in which the chemicals and explosives are used and then according to chemical families.

An indication of many postwar applications for Hercules chemicals in plastics, paints, textiles, film, adhesives and paper is given by the booklet. Chemicals in the cellulose family, rosins and modifications, rosin esters and synthetic esters, terpene solvents and chemicals, explosives, blasting supplies and sporting powders and special products are discussed.

• APPOINTED MONSANTO BRANCH MANAGER

Appointment of William M. Russell as branch manager of its Organic Chemicals Division for the Detroit territory has been announced by Monsanto Chemical Company.

Continuing as general branch manager for the Detroit territory, with general office supervision and responsibility for Phosphate Division sales, will be H. P. Walmsley.

Mr. Russell has been a Monsanto sales representative in the Detroit and Cleveland areas since June 1, 1938, and previously was a salesman in the flavors and condiments department, St. Louis.

• NEW APEX LABORATORY

The new research laboratory of the Apex Chemical Co., Inc., was dedicated on December 20th in ceremonies attended by about 150 civic leaders, company executives and representatives of other industries. Visitors later inspected the building and were shown the features of the building which include the office of the Purchasing Agent, the private laboratory of the Director of Research and Chief Chemist, individual laboratories of each 2-man research teams, as well as a large general laboratory for the research staff.

The building, two stories high, is of brick construction and consists of 1[illegible] rooms including offices. Built on a plot 40 x 60, it houses virtually all types of apparatus for research. One of its principal features is a room for bacteriological research devoted entirely to sterile fermentation and the growth of cultures. This room, which is maintained at a constant humidity and constant temperature, is irradiated by ultra violet light to maintain its sterility.

The main office is at 225 W. 34th Street, New York City.

• COMPLETES EXTENDED TRIP

Charles D. Ehrengart, Secretary of the Onyx Oil & Chemical Company, Jersey City, N. J., completed last November an extended trip to the West Coast. In addition to visiting the company's present representatives he arranged for an exten-

Charles D. Ehrengart

sion of the company's efforts in a number of additional cities. Mr. Ehrengart found possibilities most promising for greatly increased business, not only during the war but after. Mr. Ehrengart has general supervision of all of the commercial activities of his company and its subsidiaries.